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Geraghty & Miller, Inc.

ASSESSMENT OF THE PRESENCE OF FUEL IN THE SUBSURFACE AT GAS HILL, NAVAL AIR STATION, JACKSONVILLE, FLORIDA

Prepared for

SOUTHERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND
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INTRODUCTION

This report outlines the work performed under the NACIP (Navy Assessment and Control of Installation Pollutants) program, Characterization Study of the Gas Hill Site, in Jacksonville, Florida. The investigation was conducted according to the Plan-of-Action submitted by Geraghty & Miller, Inc. (G&M), on July 19, 1983. The primary objective of this study was to determine the presence or absence of jet fuel (JP-5) in the subsurface around the facility. This report has been divided into four sections, including background information, work performed, general findings, and recommendations for corrective actions.

BACKGROUND

The bulk fuel storage facility (Gas Hill) is located along Catapult Road in the northeast corner of NAS-JAX (Naval Air Station - Jacksonville), as shown in Figure 1. Presently, there exists 11 buried holding tanks for storage of both jet fuel (JP-5) and aviation gasoline (AVGAS 130) used at NAS-JAX and Cecil Field. The tank farm has a maximum storage capacity of 4.3 million gallons of petroleum products. With the exception of two concrete storage tanks, E and F, all the storage tanks are constructed of steel. The tanks were emplaced by bolting the shells to a concrete base located at land surface; the shells were subsequently covered with earth.

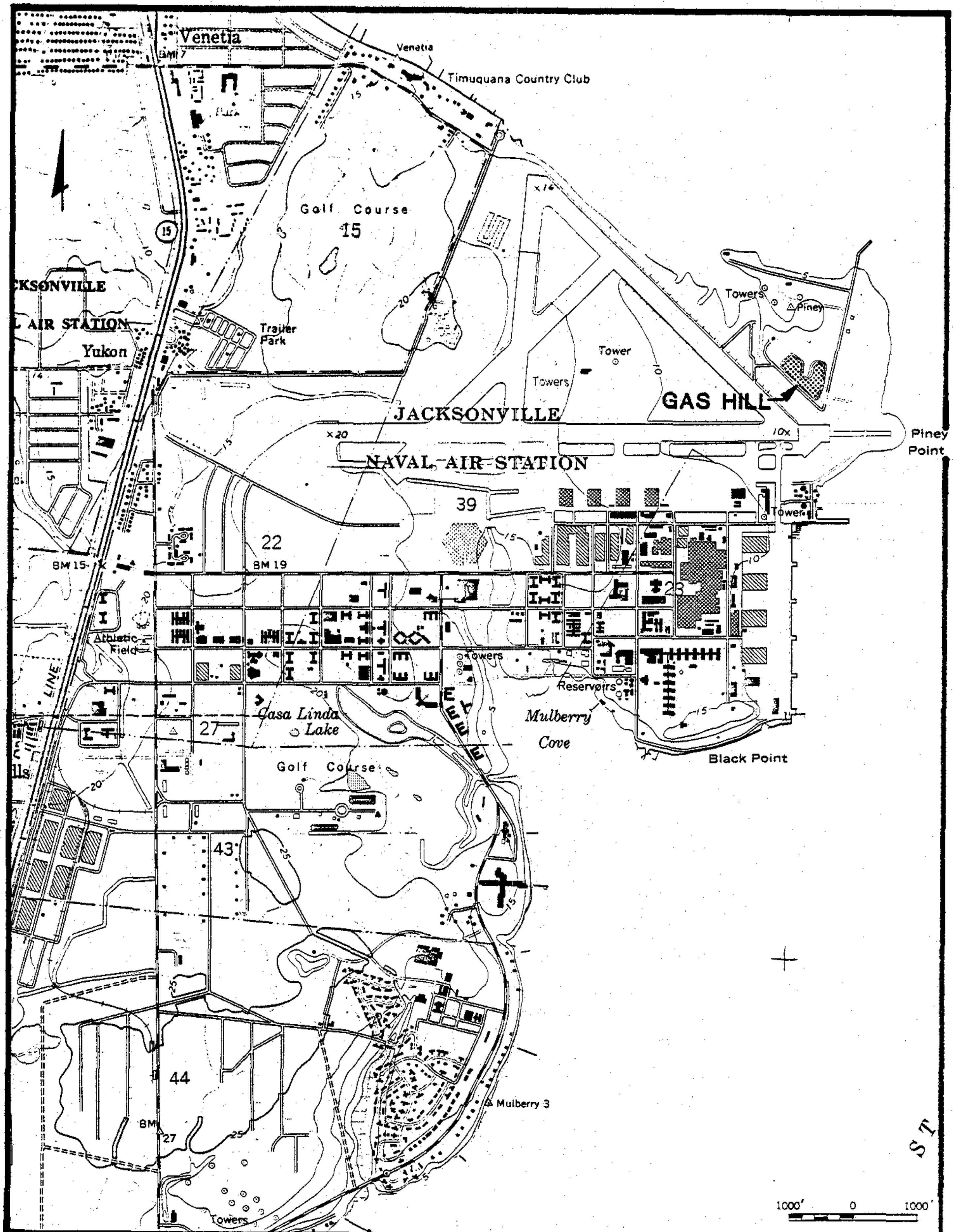


Figure 1. Map Showing the Location of Gas Hill site.

In addition to the major fuel tanks at the site, a fuel pier, truck defueling stand, pumping stations, and associated underground piping also exists around Gas Hill to facilitate the handling of these fuels. Table 1 lists the capacities and tank construction materials for each of the 11 tanks. It is reported that tanks G and I (not shown in Figure 2) exploded when struck by lightning in 1979 and 1980, respectively. Residual fuel, not consumed by the fire, was pumped into tank trucks and hauled off site for refinement as waste oil. The JP-5 storage tanks are filled from barges unloaded at a fuel pier located north of Gas Hill in the St. Johns River. The fuel is transported through underground transmission lines that extend from the pier to Gas Hill. The AVGAS tanks are filled from tanker trucks unloaded at the truck defueling stand.

The NSC (Naval Supply Center), a tenant at NAS, is responsible for the operation of the storage tanks. They became concerned about possible leaks at Gas Hill in 1982 when variances were noted between the volume received in certain tanks and volumes later pumped from these tanks. Initially, the variance was thought to have resulted from either volume changes due to temperature differences in the fuel between the time of barge unloading and later measurements in the filled storage tanks, or to a situation where the tank bottom was flexing depending on various loads (volume) of fuel in the tank.

Table 1. Construction Details and Capacities of Storage Tanks at Gas Hill.

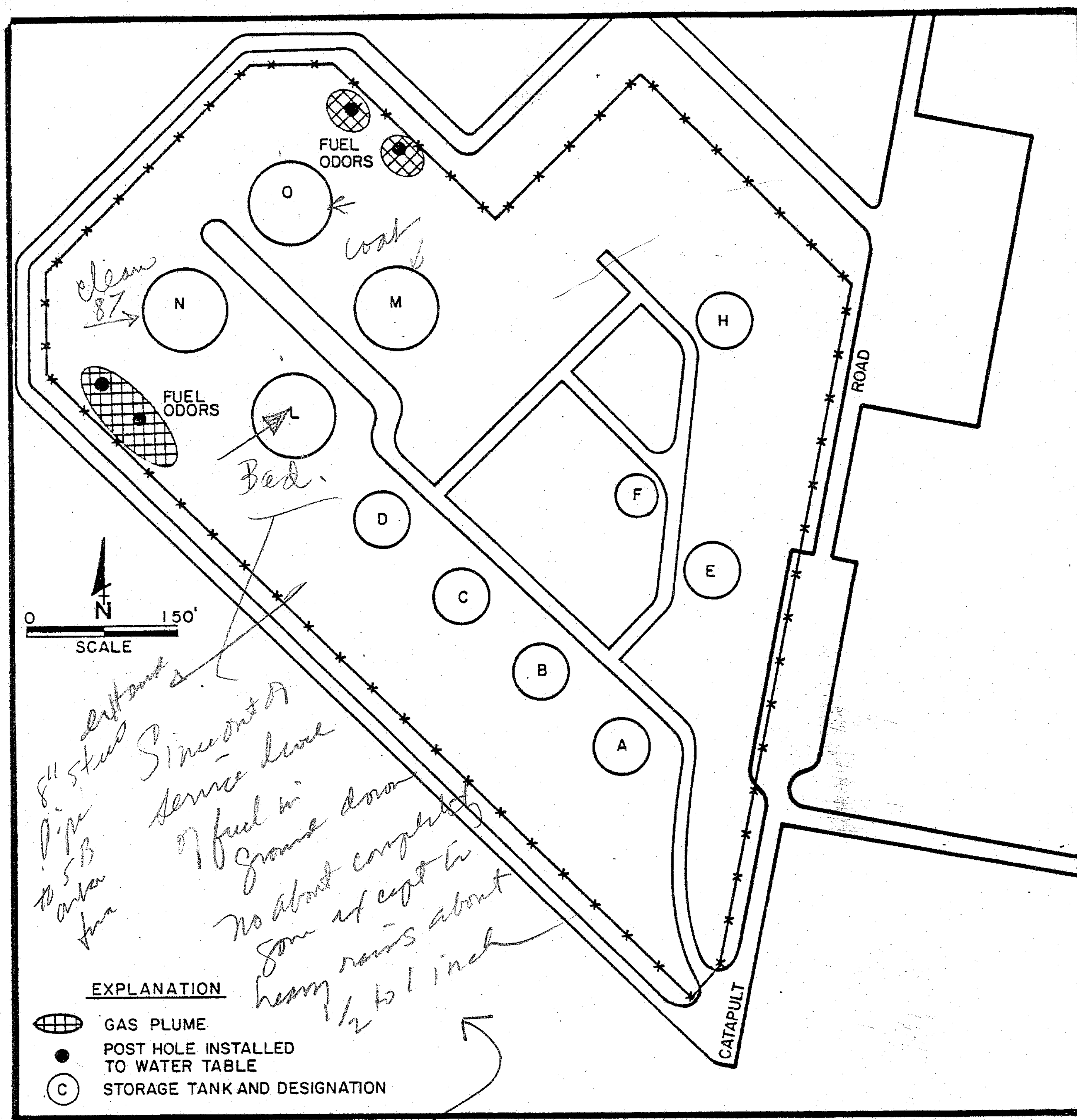
Tank	Construction Material	Capacity (gallons)
A	Steel	250,000
B	Steel	250,000
C	Steel	250,000
D	Steel	250,000
E	Concrete	100,000
F	Concrete	100,000
H	Steel	100,000
L	Steel	750,000
M	Steel	750,000
N	Steel	750,000
O	Steel	750,000

In October 1982, fuel odors were detected at two areas along the outside of the tank farm at the locations shown in Figure 2. Preliminary probing of the ground in these areas by NSC personnel revealed soil saturated with JP-5. Initially, postholes were installed to the water table in these areas to better determine the location of the fuel. The fuel seemed to occur in isolated pockets, ranging in thickness from a slight film to as much as four inches in some of the holes; these areas were monitored periodically.

In July-August 1983, the fuel transmission lines and associated piping around Gas Hill were pressure checked for leaks by an outside contractor. It was reported that all the lines were virtually intact as no leaks were detected. Also, a recent project has been undertaken by the NSC to empty, clean, and repair the large JP-5 storage tanks (L, M, N, and O) by the end of 1984. At this time, only storage tank N has been examined, and it was reported to have minor leaks at the locations where the steel tank was secured to the underlying concrete pad.

WORK PERFORMED

In August 1983, a field program, consisting of soil borings and monitor well installations was conducted at Gas Hill. The purpose of the program was to detect and delineate, where possible, the extent of JP-5 in the subsurface. As with most petroleum-based products, jet fuel (JP-5), is immiscible and has a lower specific gravity than



Source of Above Comments Unknown

Figure 2. Locations of Storage Tanks and Areas of Early Probing by NAS-JAX Personnel.

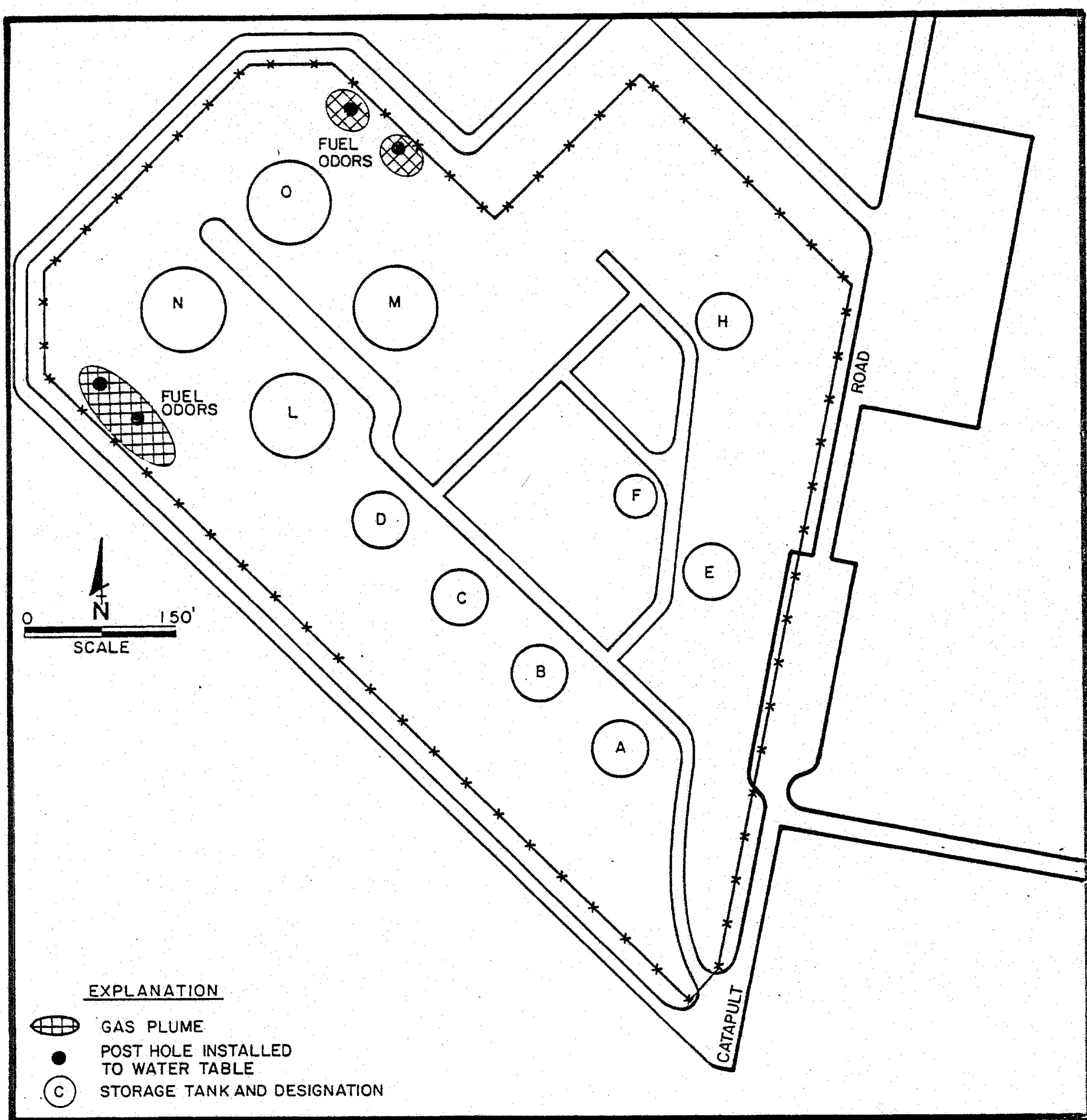


Figure 2. Locations of Storage Tanks and Areas of Early Probing by NAS-JAX Personnel.

water; therefore, any fuel which may be present in the subsurface would be on top of the shallow water table in the vicinity of Gas Hill. The soil borings, shown in Figure 3, were drilled to approximately 8 ft below the water table in order to examine the soil both above and below the water table. Initially, the soil samples were collected continuously with a split-spoon sampler to the total depth of the borehole in soil boring B-1 to B-13; an auger flight was then used for the other borings. The lithologic logs presented in Appendix A describe the mineral and physical characteristics of the soil, as prepared by an on-site G&M hydrogeologist. The sediments were also examined both visually and aromatically for the presence of fuel. Upon completion of each soil boring, the borehole was backfilled with the extracted material. At three locations, B-10, B-17, and B-27, the borings were extended by split-spoon sampling to a depth of about 25 ft below land surface to better determine the local geology. These boreholes were abandoned by filling the borehole with a neat cement grout pumped in from the bottom of the borehole to land surface.

Due to certain restrictions around Gas Hill, mainly marshy areas and a perimeter ditch and fence, it was difficult to drill near the affected areas. A hand auger was used to collect soil samples in these areas. These boreholes, also shown in Figure 3, were extended to slightly below the water table, generally 4 ft below land surface, to

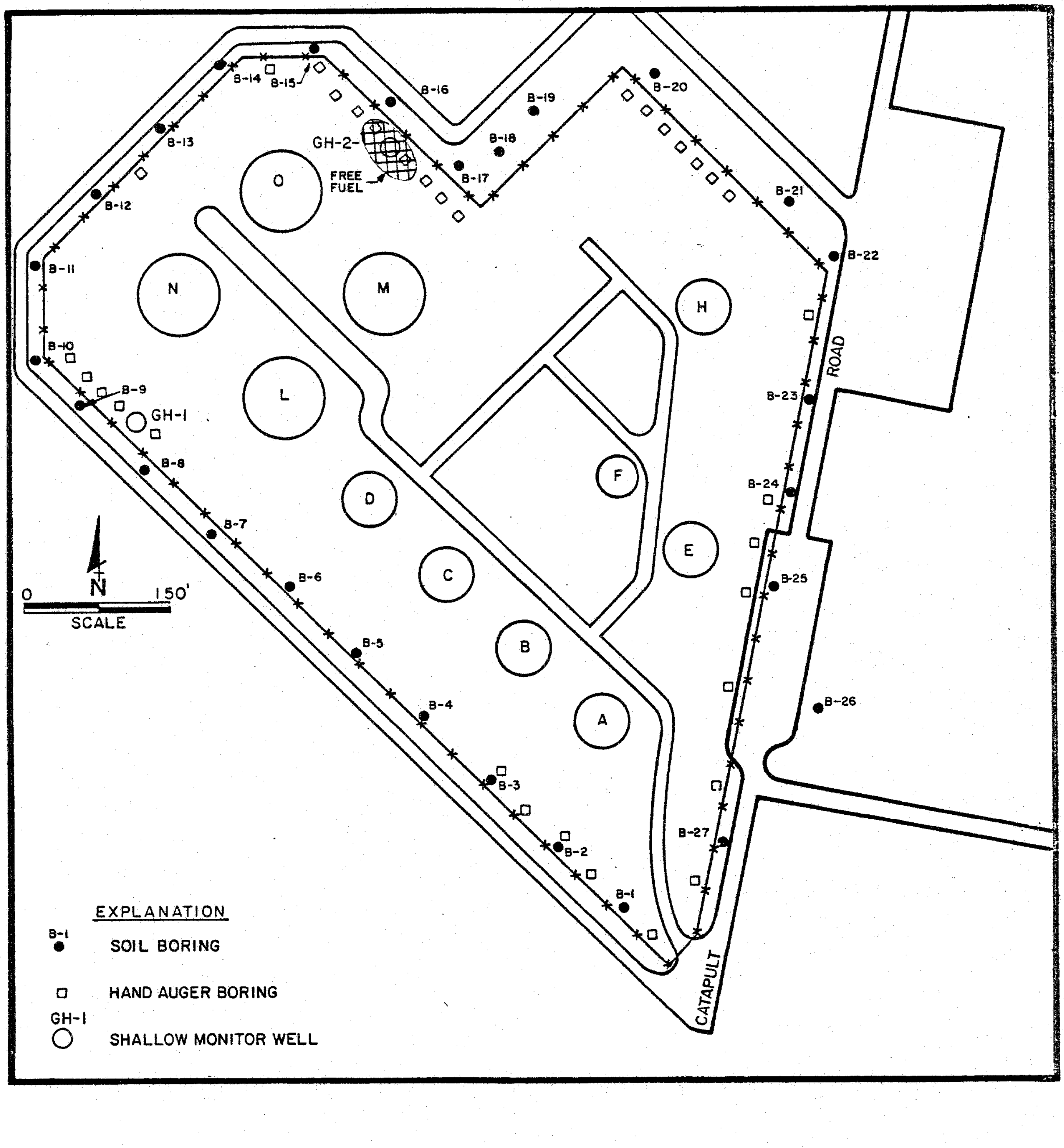


Figure 3. Locations of Soil Borings and Monitor Wells Installed at Gas Hill.

examine the soil for fuel at the saturated/unsaturated interface.

Fuel odors and free product were encountered in the same areas discovered earlier by NSC personnel. Figure 3 shows the lateral extent of free product and the locations of two monitor wells installed in the approximate center of these areas. The monitor wells were constructed by emplacing PVC pipe with an attached 3-ft slotted well screen on the bottom in an open auger hole. The screen was positioned to monitor the interface between the saturated and unsaturated zones, thereby allowing any free fuel in the ground to flow into the well. The annular space between the well casing and auger hole was backfilled with the sediments removed from the hole. Figure 4 illustrates the construction details of a typical monitor well.

The wells were bailed dry after installation to enhance ground-water flow into the wells. Subsequent measurements of water levels and JP-5 thicknesses were made during the next few weeks. The water-level measurements were made with a weighted steel tape and the jet fuel thicknesses were measured with a clear plexiglass bailer lowered into the wells. Also, a small pit, hand dug to the water table, was monitored during the ensuing weeks for the presence of JP-5. After making a measurement, any free fuel was removed from the source was discarded on-site. Table 2 summarizes the measurements made during the field program.

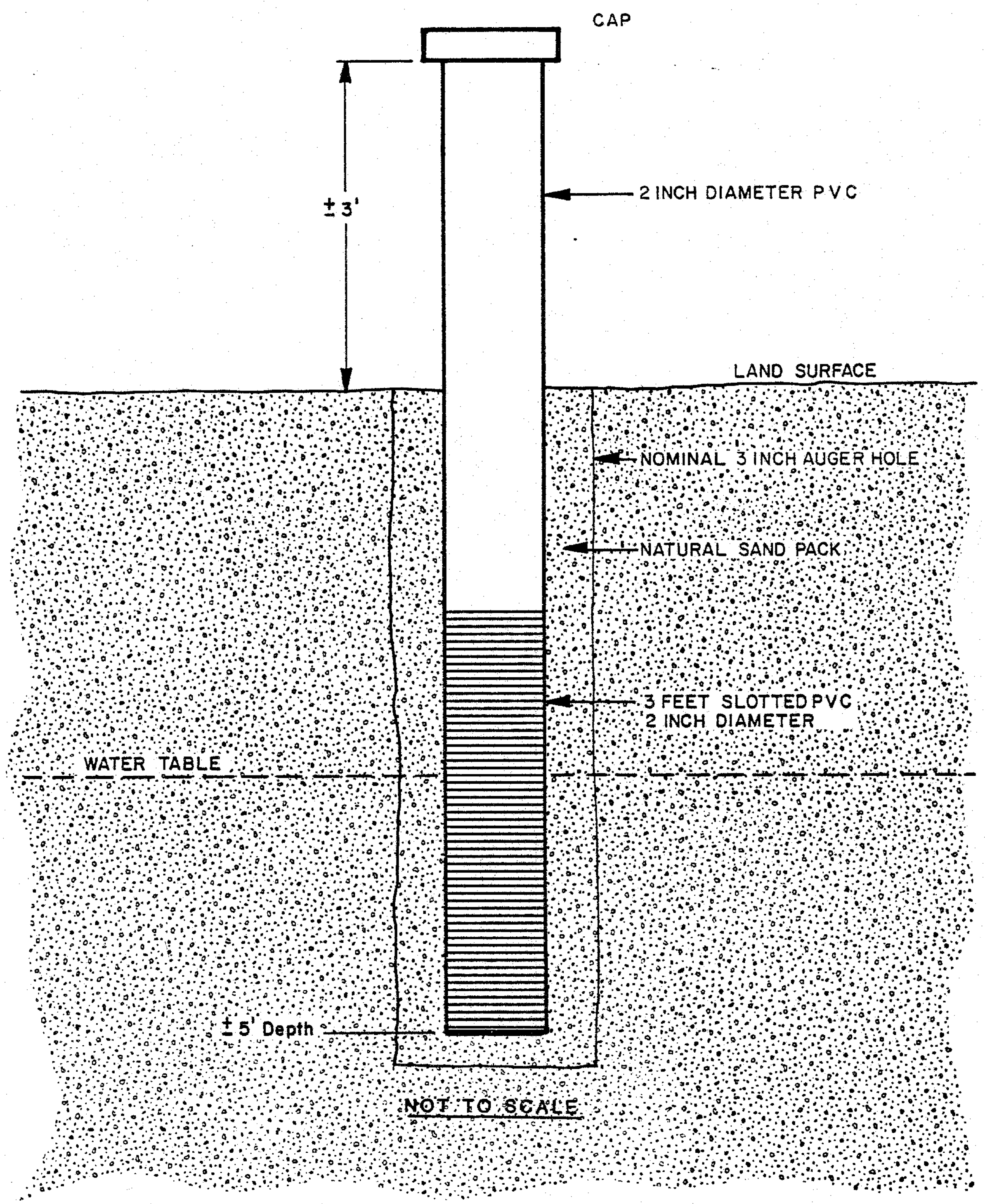


Figure 4. Schematic Diagram Showing the Typical Construction Details of Monitor Wells Installed at Gas Hill.

Table 2. Summary of Water-Level and Fuel Thickness Measurements at Gas Hill.

Sampling Point 1/	8/31/83		9/10/83		9/11/83	
	Depth to Water (ft) 2/	Fuel Thickness (in) 3/	Depth to Water (ft)	Fuel Thickness (in)	Depth to Water (ft)	Fuel Thickness (in)
GH-1	-	0	1.84	0	1.97	0
Post hole near GH-1	-	0	-	0	-	0
GH-2	-	1.0	1.70	3.0	1.49	1.0
Post hole	-	3.0	-	>3.0 4/	-	>3.0

1/ Wells were bailed dry after collecting the measurements.

2/ Measured in feet below land surface.

3/ Measured with clear plexiglass bailer.

4/ Bottom of post hole contained only fuel.

FINDINGS

The data collected to date provides the background information necessary to assess the hydrogeologic setting at Gas Hill, to determine the extent of JP-5 in the subsurface, and to make recommendations on corrective actions. Presented below is a discussion of the findings:

- o The surficial geology, based on installed and existing soil borings, indicates shallow sediments consisting of intercalated clayey sands and clays occur to a minimum depth of 25 ft. Published information suggests that these low permeability sediments extend to the top of the Floridan Aquifer or to a depth of about 400 ft. below land surface, although discontinuous lenses of sand and limestone, capable of supplying small quantities of water, may occur at some locations above the Floridan Aquifer. A well, no longer in use, located at building 201 taps one of these lenses within the clayey sediments at a reported depth of 101 ft.

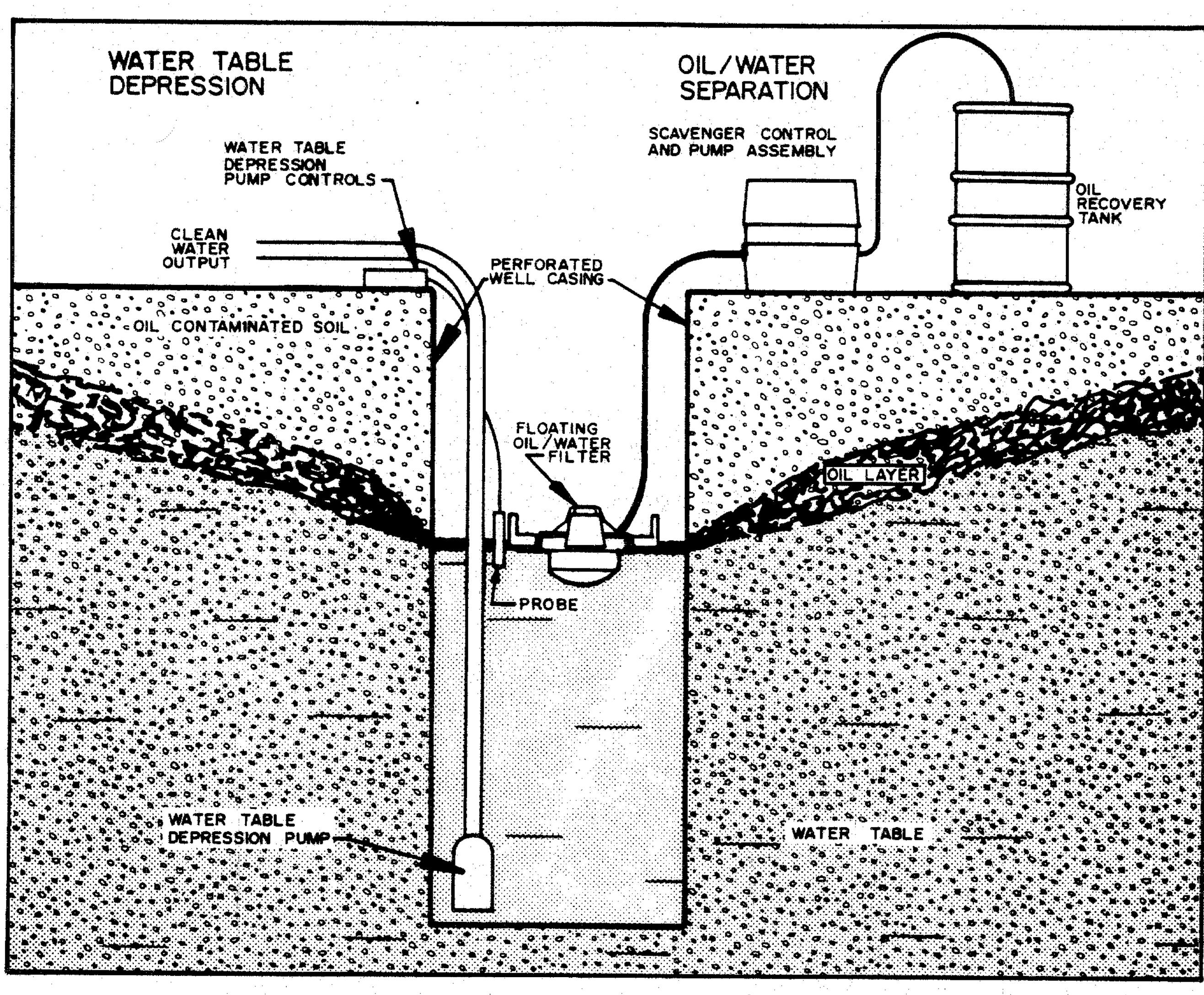
- o The water table is generally found within 4 ft. of land surface at Gas Hill. Based on topography, the shallow ground water flow in the vicinity is likely to be moving toward a topographically low swampy area located to the north. Locally, a slight mounding of the ground water may occur beneath the site, particularly after periods of heavy precipitation, causing the water table to be at or very near land surface near the base of Gas Hill. Surface water collected at the top of Gas Hill and runoff from the side slopes is collected in a perimeter ditch that encircles Gas Hill. These waters are then discharged to a drainage ditch located to the east of the site, ultimately discharging into the St. Johns River. This perimeter ditch may also intercept local shallow ground-water discharge from Gas Hill during high water table periods.

o As shown in Figure 2, two areas at Gas Hill were found by the Navy personnel to contain some evidence of fuel in the subsurface. Based on G&M's field program, the southernmost area (see Figure 3) does not appear to contain an appreciable amount of free product and therefore a recovery program in this area is not feasible. The area to the north, however, has consistently shown the presence of free fuel in the subsurface. Although the areal extent of the JP-5 plume has not been determined precisely due to the drilling constraints discussed earlier, the plume appears to be very localized, as seen in Figure 3.

RECOMMENDATIONS

Based on the fuel measurements in the installed monitor wells and auger holes drilled along the south side of Gas Hill, there does not appear to be a need for any remedial actions at this location.

It has been determined that a small quantity of JP-5 is present in the subsurface north of Gas Hill in several isolated areas around monitor well GH-2. To purge the free fuel from the ground, it is recommended that a recovery well be installed in the vicinity of monitor well GH-2. The recovery well, shown in Figure 5, would consist of a perforated, corregated pipe covered with a fine filter cloth. The recovery system should be constructed by installing the slotted pipe in a large excavated pit in the center of the contaminated area and backfilling with a pea-sized gravel. The depth of the well should be approximately 10 to 12 ft below land surface in order to achieve sufficient drawdown (cone of depression) of the water table. Due to the clayey sediments found beneath Gas Hill, the gravel pack is necessary to increase the permeability immediately surrounding the recovery well. The soil removed from the excavation should be spread on the ground near the well to allow biodegradation of the JP-5 and/or drainage of the fuel into the subsurface where it can be quickly recovered.



SOURCE: OIL RECOVERY SYSTEMS, INC.

Figure 5. Schematic Diagram Showing the Layout of a Scavenger Well Recovery System.

The recovery well should be equipped with two pumps as illustrated in Figure 5. The first pump is installed at the bottom of the well to remove ground water thereby creating a cone of depression in the water table around the well. This induces the fuel to move toward and into the well where it is removed by a second pump floating on top of the water table in the well. This second pump periodically discharges the recovered fuel into an above-surface storage tank. This procedure requires careful monitoring to be sure that each pump is extracting only the fluid for which it was intended. If done properly, the fuel and water can be essentially separated in the well, thus minimizing the need to separate the fluids at land surface. Free product removed from the well may be drummed and disposed of as waste oil for re-refinement and resale or used as a source of combustible material at the fire-fighting area.

The ground water removed by the water-table depression pump should be spray irrigated in the grassy area near the recovery well. A fine mist or fogging-type spray nozzle should be used to maximize the surface area of the water droplets. In doing so, any volatile organic compounds dissolved in the ground water will volatilize before reaching the water table. The remaining compounds should biodegrade by naturally-occurring bacteria in the soil.

Assuming that the Navy already owns a scavenger-pump system, the cost for installing this system is estimated to be approximately $5,000.

CLOSING COMMENTS

The information presented herein represents the work performed during the characterization phase of the NACIP confirmation study at Gas Hill. At this time, the total volume of fuel in the ground is small, and the source or sources contributing to the presence of JP-5 is unknown. The present tank cleaning program and inspection will be beneficial in providing additional information as to the potential source(s) of fuel in the subsurface.

Geraghty & Miller, Inc. greatly appreciates the opportunity to assist the Navy with this program. G&M would also like to acknowledge the assistance of a number of individuals, namely, Curtis McLemore, Robert Babbick, Bill Roche, and Dick Bozung, from the Naval Fuel Depot, NAS-JAX, and Southern Division of NAVFAC that have provided valuable input throughout this phase of investigation. If there are any questions concerning this report or the remedial action presented, please give us a call.

Sincerely,

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APPENDIX A

Lithologic Logs of Soil Borings

LITHOLOGIC LOG OF BORING B-1

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown, mixed with organics	0 - 1	1
Sand, fine, gray to brown	1 - 7	6
Sand, clayey, fine, gray, iron stained	7 - 9	2

LITHOLOGIC LOG OF BORING B-2

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown, mixed with organics and shell	0 - 1	1
Sand, fine, brown	1 - 6	5
Sand, clayey, fine, gray to brown, iron stained with stringers of gray, sandy clay	6 - 10	4

LITHOLOGIC LOG OF BORING B-3

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown, mixed with organics and shell	0 - 1	1
Sand, silty, fine, gray to brown	1 - 6	5
Sand, clayey, fine, gray, iron stained with gray, sandy clay	6 - 10	4

LITHOLOGIC LOG OF BORING B-4

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown to black mixed with organics......................	0 - 2	2
Sand, silty, fine, gray to brown..........	2 - 6	4
Material from upper borehole.............	6 - 10	4

LITHOLOGIC LOG OF BORING B-5

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown to gray, mixed with organics......................	0 - 2	2
Sand, silty, fine, gray to brown..........	2 - 4.5	2.5
Sand, clayey, fine, gray, iron stained, mixed with roots.........................	4.5 - 10	5.5

LITHOLOGIC LOG OF BORING B-6

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown to gray, mixed with organics......................	0 - 1	1
Sand, silty, fine, brown, iron stained....	1 - 3.5	2.5
Clay, sandy, gray, iron stained, mixed with organics............................	3.5 - 9	5.5

LITHOLOGIC LOG OF BORING B-7

Description	Depth (ft)	Thickness (ft)
Sand, fine, gray to brown................	0 - 6	6
Lost sample..............................	6 - 8	2
Clay, sandy, gray, mixed with organics....	8 - 9	1

LITHOLOGIC LOG OF BORING B-8

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown..........	0 - 2	2
Sand, clayey, fine, gray, mixed with organics and stringers of gray, sandy clay..................................	2 - 9	7

LITHOLOGIC LOG OF BORING B-9

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown, mixed with organics and shell	0 - 1.5	1.5
Sand, clayey, fine, gray, mixed with some organics.................................	1.5 - 9.5	8.0

LITHOLOGIC LOG OF BORING B-10

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, brown, mixed with organics.................................	0 - 1	1
Sand, clayey, fine, gray, mixed with organics.................................	1 - 11	10
Clay, sandy, gray, stiff..................	11 - 21	10
Clay, greenish-gray, soft.................	21 - 25	4

LITHOLOGIC LOG OF BORING B-11

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown to tan, mixed with organics and shell.............	0 - 2	2
Sand, clayey, fine, gray, mixed with organics.................................	2 - 9	7

LITHOLOGIC LOG OF BORING B-12

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown to tan, mixed with organics and shell.............	0 - 2	2
Sand, fine, white..........................	2 - 4	2
Material from upper borehole.............	4 - 7	3

LITHOLOGIC LOG OF BORING B-13

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown, mixed with organics; fill material.............	0 - 4	4
Sand, clayey, fine, gray..................	4 - 7	3

LITHOLOGIC LOG OF BORING B-14

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown, iron stained; fill material..................	0 - 3.5	3.5
Sand, clayey, fine, gray, iron stained....	3.5 - 5.0	1.5
Clay, sandy, gray, iron stained...........	5 - 9	4

LITHOLOGIC LOG OF BORING B-15

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, black to brown, pieces of cemented sand; fill material..........	0 - 2.5	2.5
Clay, sandy, gray, iron stained, becoming greenish-gray and more sandy at 8 ft......	2.5 - 9.0	6.5

LITHOLOGIC LOG OF BORING B-16

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, black to brown, pieces of cemented sand and shell...............	0 - 2	2
Sand, fine, brown........................	2 - 3	1
Clay, sandy, gray, iron stained..........	3 - 9	6

LITHOLOGIC LOG OF BORING B-17

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, black to brown, mixed with organics, limestone, and shell.......	0 - 6	6
Clay, sandy, gray, iron stained..........	6 - 14	8
Clay, gray, soft, with shell.............	14 - 22	8

LITHOLOGIC LOG OF BORING B-18

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, brown to gray, mixed with organics and shell..................	0 - 3.5	3.5
Clay, sandy, gray, iron stained...........	3.5 - 5.0	1.5
Peat, black organic matter and roots......	5 - 6	1
Sand, silty, fine, brown..................	6 - 8	2
Clay, sandy, gray, iron stained...........	8 - 9	1

LITHOLOGIC LOG OF BORING B-19

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown, mixed with organics; fill material..............	0 - 6	6
Clay, sandy, gray, iron stained...........	6 - 9	3

LITHOLOGIC LOG OF BORING B-20

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown.............	0 - 0.5	0.5
Clay, sandy, gray, iron stained...........	0.5 - 6.0	5.5
Sand, silty, fine, gray to brown..........	6 - 7.5	1.5
Clay, sandy, gray, iron stained...........	7.5 - 9.0	1.5

LITHOLOGIC LOG OF BORING B-21

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, dark brown to gray, mixed with organics......................	0 - 1.5	1.5
Clay, sandy, gray, iron stained..........	1.5 - 6.0	4.5
Sand, silty, fine, brown.................	6 - 7	1
Clay, sandy, gray, iron stained..........	7 - 9	2

LITHOLOGIC LOG OF BORING B-22

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown, mixed with organics; fill material.............	0 - 2.5	2.5
Clay, sandy, gray, iron stained..........	2.5 - 5.0	2.5
Sand, silty, fine, gray..................	5 - 8	3
Clay, sandy, gray, iron stained..........	8 - 9	1

LITHOLOGIC LOG OF BORING B-23

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown, mixed with organics; fill material.............	0 - 6.5	6.5
Sand, clayey, fine, gray.................	6.5 - 7.0	0.5
Clay, sandy, gray, iron stained..........	7 - 9	2

LITHOLOGIC LOG OF BORING B-24

Description	Depth (ft)	Thickness (ft)
Sand, silty, fine, gray to brown mixed with organics	0 - 6.5	6.5
Clay, sandy, gray	6.5 - 9.0	2.5

LITHOLOGIC LOG OF BORING B-25

Description	Depth (ft)	Thickness (ft)
Limestone, roadbase	0 - 1	1
Sand, silty, fine, dark gray to brown; fill material	1 - 5	4
Clay, sandy, gray, iron stained	5 - 9	4

LITHOLOGIC LOG OF BORING B-26

Description	Depth (ft)	Thickness (ft)
Limestone, roadbase	0 - 1	1
Sand, silty, fine, gray to brown; fill material	1 - 5	4
Sand, clayey, fine, gray, iron stained	5 - 7.5	2.5
Clay, sandy, gray, iron stained	7.5 - 9.0	1.5

LITHOLOGIC LOG OF BORING B-27

Description	Depth (ft)	Thickness (ft)
Limestone, roadbase	0 - 1	1
Sand, silty, fine, gray to brown, iron stained	1 - 5	4
Clay, sandy, gray, iron stained	5 - 10.5	5.5
Sand, silty, fine, gray	10.5 - 16.0	5.5
Sand, clayey, fine, gray	16.0 - 17.5	1.5
Clay, sandy, gray, iron stained	17.5 - 22.5	5.0